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Scorpions from Northern Mexico: Five New
Species of *Vejovis* from Coahuila, Mexico

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ABSTRACT: Five new species of scorpions, *Vejovis gilvus*, *Vejovis pallidus*, *Vejovis cazieri*, *Vejovis coahuilae*, and *Vejovis minckleyi* were collected in the Cuatro Cienegas basin of Coahuila, Mexico and are here described. Only one of these species, *Vejovis coahuilae*, is known from outside of the small intermontane Cuatro Cienegas basin.

INTRODUCTION

The purpose of this paper is to describe and name five new species of scorpions belonging to the genus *Vejovis*, from the Cuatro Cienegas basin of Coahuila, Mexico. The descriptions of these five species are based on 227 specimens collected between the years 1965 and 1967. In addition to these, other specimens representing three genera and three families were collected. These, however, will not be discussed in this paper because adequate material is not available at this time. It appears that the Cuatro Cienegas basin may very well have one of the richest scorpion faunas in North America.

The measurements of specimens given in this paper are generally the standard ones used in scorpion systematics. Measurements were taken with the use of a microscope equipped with a calibrated eyepiece micrometer. The total body length is the sum of the lengths of the carapace, mesosoma, metasoma, and telson. Carapace length was taken along a plane tangent to the lateral margin of the ocular tubercule. The mesosoma length was measured along the dorsal median plane. The metasoma length is the sum of the separate lengths of each segment measured dorsally. Telson length is the sum of vesicle and aculeus

lengths. The middle lamellae counts refer only to the number of subcircular sclerites forming a single distinct row. An index of hirsutness is given by indicating the number of large reddish hairs on each of several body parts (namely, inferior keels of metasoma, vesicle, fulcra and middle lamellae).

ACKNOWLEDGMENTS

Sincere thanks and appreciation to Wendell L. Minckley who has stimulated so much interest in the little known, yet fascinating Cuatro Cienegas basin; to Wendell L. Minckley, Charles O. Minckley, Walter K. Taylor, William S. Parker, Les E. Cullum, Robert Winokur, and Jose Lugo, Jr. for collecting many of the specimens used in this study; and to William S. Brown and Modesto de la Garza P. for assistance in the field. Thanks are also due to Charlene F. Williams for clerical assistance.

THE CUATRO CIENEGAS AREA

Cuatro Cienegas is a small, horseshoe-shaped valley approximately 40×30 kilometers, enclosed by ranges of the Sierra Madre Oriental in central Coahuila, Mexico. It gets its name from a small agricultural town called Cuatro Cienegas de Carranza (in this paper referred to as Cuatro Cienegas). The rugged mountains are steep, bare, and composed of Cretaceous limestone. The valley lies at an elevation of about 700 to 750 meters above sea level, has a vegetation of the Chihuahuan desert type, and is noted to biologists for its interesting and varied aquatic habitats and drainages. Several completely internal drainage systems occur as well as an external drainage toward the Rio Grande. The area has recently received distinction because of its rich snail and fish faunas which contain many endemic species.

NEW SPECIES

Vejovis gilvus Williams, new species.

(Figures 1, 2.)

DIAGNOSIS. This small to moderate sized species of *Vejovis* generally appears much like *Vejovis confusus* Stahnke, but differs in the following ways: adult body smaller and less robust (about $\frac{1}{2}$ the size of *V. confusus*); base color more whitish-yellow than the more orange-yellow *V. confusus*; faint dusky markings on carapace, dorsum of mesosoma, metasoma V, and telson; obsolete dorsal stripes on mesosoma; ventral side of vesicle smooth, not distinctly granular; palm proportionally more swollen inwardly; and pedipalp chela distinctly less elongate.

Mature males and females about same body size; base color pale to dirty yellow; diffuse dusky pigment on carapace, faint to obsolete; one pair of faint stripes on mesosoma, these obsolete to completely absent; diffuse dusky pigment on telson and metasoma segment V, this faint to absent. Pedipalps with hand only slightly swollen inwardly; with palm keels agranular, much reduced to

obsolete; palm longer than fixed finger but shorter than carapace. Metasoma with inferior lateral keels crenulate to serrate on all segments; inferior median keels present on all segments but reduced in anterior segment, these keels smooth to crenulate anteriorly and approaching serrate condition in fourth segment. Pectinal teeth 16 to 18 in males, 11 to 13 in females.

DESCRIPTION OF HOLOTYPE (male). *Coloration:* Base color of cuticle pale yellow; cuticle almost transparent with heart showing externally; faint dusky pigmentation of carapace, most distinct anteriorly; dark transverse line marks posterior margin of carapace; ocular tubercule black; anterior tergites of mesosoma with faint, submedian, diffuse, dusky pigmentation, forming an obsolete pair of dorsal stripes; faint, diffuse, dusky pigment on metasomal segment V and telson, telson with a pair of ventral, submedian, yellow stripes; pectines slightly whiter in color than sternites; walking legs lighter yellow than dorsum of trunk; pedipalps light yellow except for reddish-amber fingers.

Carapace: Anterior margin straight, with six reddish bristles. Median eyes on raised ocular tubercule; one large, reddish, bristle on ocular tubercule posterior to each eye; diad slightly more than $\frac{1}{2}$ carapace width at that point. Carapace surface irregularly covered by abundant large granules; median groove continuous over ocular tubercule, forming deep vertical pit near posterior border of carapace.

Mesosoma: Anterior tergites with large granules, these most abundant postero-laterally; median keels absent on tergite one, indistinct on two, granular on three to six, smooth to granular on seven; tergite seven with two pairs of lateral keels, each set with large dentate to serrate granules; sternites smooth and agranular; with one pair of serrate keels on last sternite.

Metasoma: Lateral keels present and serrate on posterior $\frac{3}{4}$ of segment I, and posterior $\frac{1}{4}$ of II and III, absent on IV, present and serrate to crenulate on anterior $\frac{1}{2}$ of V. Inferior lateral keels well developed and serrate on all segments. Inferior median keels distinct on all segments; these keels smooth to crenulate on segments I and II, crenulate on III, crenulate to serrate on IV, serrate on V. Inferior median keels with reddish bristles, three pairs on segments I and II, four pairs on III, five pairs on IV, four pairs on inferior intercarinal space of V.

Telson: Ventral side of vesicle with about 14 long slender reddish hairs, none of these bristle-like; ventral aspect of vesicle agranular, but with uneven surface because of punctate depressions. No distinct subaculear tubercule present.

Pectines: 11 subcircular middle lamellae; 16 teeth per comb. Ventral surface of each fulcrum with three to five reddish bristles; ventral surface of each middle lamella with two to four reddish bristles.

Genital operculum: Completely divided longitudinally; genital papillae visible externally.

TABLE 1. *Measurements (in millimeters) of Vejovis gilvus, new species, holotype and allotype.*

	<i>holotype</i> (<i>male</i>)	<i>allotype</i> (<i>female</i>)
Total length	34.4	33.4
Carapace, length	4.2	4.5
width (at median eyes)	3.1	3.2
Mesosoma, length	8.5	10.4
Metasoma, length	16.6	15.0
segment I, (length/width)	2.2/2.5	2.0/2.4
segment II, (length/width)	2.6/2.4	2.3/2.4
segment III, (length/width)	2.7/2.4	2.4/2.3
segment IV, (length/width)	3.6/2.3	3.2/2.2
segment V, (length/width)	5.5/2.2	5.1/2.2
Telson, length	5.1	—
Vesicle, (length/width)	3.9/1.9	3.5/2.2
depth	1.6	1.8
Aculeus, length	1.2	—
Pedipalp		
Humerus, (length/width)	3.1/1.2	3.1/1.1
Brachium, (length/width)	3.4/1.4	3.3/1.5
Chela, (length/width)	5.5/1.8	5.7/1.6
depth	1.8	1.8
movable finger, length	3.1	3.4
fixed finger, length	2.2	2.5
palm, length	3.3	3.2
Pectines, teeth (left/right)	16/16	13/12
middle lamellae	11	9

Chelicerae: Inferior border of movable finger smooth, completely lacking denticles; superior border set with four distinct simple pointed teeth.

Pedipalps: Hand slightly swollen inwardly, keels reduced and agranular. Fixed finger, movable finger and palm each distinctly shorter than carapace; fixed finger distinctly shorter than palm. Pedipalp fingers do not contact along proximal $\frac{3}{4}$ when fingers closed. Inner margin of fingers only mildly scalloped and with serrate denticles extending almost to proximal inner border.

Standard measurements and photographs: Table 1 and figures 1 and 2.

DESCRIPTION OF ALLOTYPE (female). Approximates holotype in total length, but with relatively longer carapace and mesosoma and shorter metasoma. Base color and color patterns same as holotype with the following exceptions: Diffuse dusky pigmentation reduced on carapace; submedian diffuse pigment of mesosomal tergites slightly more distinct, but dorsal stripes still obsolete; metasomal segment V with diffuse dusky pigment on inferior surface, similar faint dusky pigment subtly underlines inferior median keels of segment IV. Structurally, allotype essentially the same as holotype with the following exceptions: pectines with fewer teeth (13/12 instead of 16/16), middle lamellae reduced in number



FIGURE 1. *Vejovis gilvus*, new species. Dorsal view of holotype.

(9 instead of 11); no genital papillae, genital operculum not completely divided; carapace and tergites not as heavily granular, even slightly lustrous in places.

Standard measurements: Table 1.

VARIATION WITHIN PARATYPES. Study of seven paratypes (6 males, 1 female) indicated little variation from holotype and allotype. The specimens all appeared mature except that the female was probably subadult. The major differences from the holotype were: diffuse, dusky, pigment of carapace generally reduced to almost absent; dusky, diffuse pigment of tergites reduced or absent; little or no dusky pigment on last metasomal segment of telson; pectinal tooth count varied from 16 to 18 in males, 11 in female; cuticle not as transparent as holotype, appearing more granular on carapace and tergites. Total length varied from 24 to 30.5 millimeters. Mature individuals of both sexes were very similar, main sexual dimorphisms being presence of genital papillae in mature male, slightly longer metasoma in male, and pectine structure.

TYPE DATA AND ETYMOLOGY. The holotype, allotype, and two paratopotypes were collected on white gypsum sand dunes 13 kilometers southwest of Cuatro Ciénegas, Coahuila, Mexico, 27 July 1967, by S. C. Williams and W. S. Brown (fig. 3). The holotype and allotype are permanently deposited in the California Academy of Sciences.

This species is named "*gilvus*" because of its light yellowish coloration.

MATERIAL. In addition to the holotype, allotype, and two paratopotypes,



FIGURE 2. *Vejovis gilvus*, new species. Ventral view of holotype.

six additional paratypes were studied. These were all from the following locations in the Cuatro Ciénegas basin of Coahuila, Mexico: Pozos de la Becerra, 14 kilometers southwest of Cuatro Ciénegas, 28 July 1967 (S. C. Williams, W. S. Brown), 2 males, 1 female; above Rio Cañon, 4.3 kilometers north northwest of Cuatro Ciénegas, 15 August 1967 (W. L. Minckley), 2 males; Travertine Ridge, 13 kilometers southwest of Cuatro Ciénegas, 15 August 1967 (W. L. Minckley), 1 male.

COMMENT. This species is known only from the Cuatro Ciénegas basin. Here it was collected in four of the ten localities sampled, but was not abundant in any of these. The specimens collected were predominantly males, and these were mostly adults. All specimens were collected by means of ultraviolet detection.

***Vejovis pallidus* Williams, new species.**

(Figures 4, 5.)

DIAGNOSIS. Large, pale-yellow species of *Vejovis*, completely lacking dark pigmentation except for diffuse, dusky, interocular crescent. Distal tooth on upper margin of movable finger of chelicera reduced in size and far smaller than corresponding tooth of lower margin; denticles present on inferior border of movable cheliceral finger. Pedipalp palms swollen inwardly, and with granular keels. Metasoma long and slender; with all inferior lateral keels distinct, these crenulate to serrate. Pectinal teeth 17 to 20 in female, 25 to 31 in male. Closest



FIGURE 3. White gypsum sand dunes 13 kilometers southwest of Cuatro Ciénegas, Coahuila, Mexico. This is the type locality for *Vejovis gilvus*, new species.

relative is probably *Vejovis gracilior* (Hoffmann) based on similar morphology of chelicerae, pedipalp hands, anterior margin of the carapace and general proportions of the metasoma. This species can, however, be distinguished from *V. gracilior* by lack of dark pigmentation on mesosomal dorsum, lack of solid pigment throughout interocular triangle, and structure of inferior metasomal keels. *Vejovis pallidus* should be placed in the subgenus *Paruroctonus* because of the presence of denticles on the inferior border of the movable cheliceral finger.

DESCRIPTION OF HOLOTYPE (male). *Coloration:* Carapace, mesosoma, metasoma and pedipalps uniform pale-yellow; walking legs similar to pedipalps but lighter; pectines almost white. Only contrasting color markings: eyes black, teeth of chelicerae and pedipalps reddish, aculeus dark reddish-brown, tips of pretarsal claws reddish-brown, interocular crescent diffuse and dusky. Cuticle almost transparent, with heart showing dorsally.

Carapace: Anterior margin with median area extending more anterior, no median notch; anterior margin with six reddish bristles; lateral eyes three per group, most anterior eye in each group largest. Median eyes on raised ocular tubercule; one large bristle on ocular tubercule medial to and one posterior to each eye; diad greater than $\frac{1}{4}$ carapace width at that point. Carapace surface, including ocular tubercule covered with large granules; median groove short, broad, and shallow anterior to ocular tubercule, ends as deep pit near posterior carapace margin.

Mesosoma: All tergites densely covered by large granules; median keels absent on tergites 1 and 2, tergites 3 to 6 with serrate keels on each posterior half, tergite 7 with smooth to serrate keel on middle $\frac{1}{3}$ of tergite. Lateral keels only on tergite 7, two pairs present, these dentate medial pair limited to posterior $\frac{1}{2}$ of tergite, lateral pair limited to posterior $\frac{1}{3}$ of tergite. Sternites smooth and agranular; one pair of crenulate keels on posterior $\frac{2}{3}$ of last sternite.

Metasoma: Lateral keels present and dentate on segment I, represented as four posterior granules on II, represented as three posterior granules on III, absent on IV, crenulate on anterior $\frac{1}{3}$ of V. Inferior lateral keels present on all segments: irregularly crenulate on segments I to IV, strongly serrate on V. Inferior median keels on segments I to IV complete and paired, complete and single on V; on segments I to III represented as smooth carinae, on IV smooth to crenulate, on V irregularly serrate. Inferior median keels set with reddish bristles on segments I to IV, 3 pairs on I, 5 pairs on II and III, 7 pairs on IV; ventral surface of segment V with 12 reddish bristles.

Telson: Ventral side with 20 long, reddish hairs, each approximately $\frac{2}{3}$ aculeus length, and with more numerous short, whitish hairs. Vesicle basically smooth; with subtle subaculear tubercule.

Pectines: 22 subcircular middle lamellae in linear row; about 5 irregularly placed accessory lamellae between middle row and marginal lamellae; each middle lamella with 3 to 5 reddish bristles; each fulcrum with about 6 to 8 reddish bristles; 29 pectinal teeth. Anterior border of marginal lamellae densely covered by reddish bristles.

Genital operculum: Completely divided longitudinally; large distinct genital papillae visible externally; inferior surface of genital operculum covered with 11 reddish bristles.

Chelicerae: Inferior border of movable finger with three small unpigmented denticles; terminal tooth of superior border of movable finger much shorter than, and not opposing terminal tooth of inferior border.

Pedipalps: Hand swollen inwardly, all keels distinct and covered by large rounded granules; fixed finger distinctly shorter than carapace, movable finger slightly longer than carapace; internal margin of fingers slightly scalloped; teeth extend to proximal end of fingers; no distinct open space between fingers when chela closed.

Standard measurements and photographs: Table 2 and figures 4 and 5.

DESCRIPTION OF ALLOTYPE (female). Essentially the same as holotype in color and morphology with the following exceptions: All metasomal segments slightly reduced in length and width; vesicle of telson longer and wider; pedipalp chela longer but reduced in width and depth; movable and fixed fingers of pedipalp longer, palm longer but not as swollen inwardly; pectines reduced in length and width, with reduced number of teeth (18 instead of 29), with fewer

TABLE 2. *Measurements (in millimeters) of Vejovis pallidus, new species, holotype and allotype.*

	<i>holotype</i> (<i>male</i>)	<i>allotype</i> (<i>female</i>)
Total length	58.1	56.5
Carapace, length	6.8	7.3
width (at median eyes)	5.6	6.2
Mesosoma, length	14.0	15.3
Metasoma, length	30.3	26.6
segment I, (length/width)	3.8/3.4	3.5/3.2
segment II, (length/width)	4.8/3.2	4.2/2.9
segment III, (length/width)	5.0/3.0	4.6/2.8
segment IV, (length/width)	6.7/2.7	5.7/2.5
segment V, (length/width)	10.0/2.5	8.6/2.6
Telson, length	7.0	7.3
Vesicle, (length, width)	4.2/2.2	4.5/2.6
depth	2.2	2.2
Aculeus, length	2.8	2.8
Pedipalp		
Humerus, (length/width)	5.9/1.8	6.0/2.1
Brachium, (length/width)	5.7/2.4	6.2/2.7
Chela, (length/width)	11.2/3.7	12.3/3.4
depth	4.8	4.6
movable finger, length	6.2	7.1
fixed finger, length	5.2	5.6
palm, length	6.0	6.7
Pectines, teeth (left/right)	29/29	18/18
middle lamellae	22	16

middle lamellae (16 instead of 22); inferior keels of metasoma not as strongly developed, median ones of anterior segments approach obsolescence.

Standard measurements: Table 2.

VARIATION WITHIN PARATYPES. A total of 88 paratopotypes (64 males, 24 females) were studied. The females varied in carapace length from 3.8 to 7.2 millimeters (mode 7.2). The males varied in carapace length from 3.0 to 6.6 millimeters (mode 5.6). Pectinal tooth count varied from 17 to 20 (mode 18 and 19) in females and from 25 to 31 (mode 28) in males. Vesicle of mature females longer and broader than in mature male; pedipalp palm more inwardly swollen on mature male than on mature female; juveniles with less swollen pedipalp hand. Interocular crescent varied from dark and distinct to light and indistinct. The structure, coloration and proportion of paratopotypes were essentially the same as described for holotype and allotype.

TYPE DATA AND ETYMOLOGY. The holotype, allotype, and 88 paratopotypes were collected 0.5 kilometer southwest of Cuatro Ciénegas, Coahuila, Mexico, 28 July 1967 by S. C. Williams and W. S. Brown. These specimens were col-

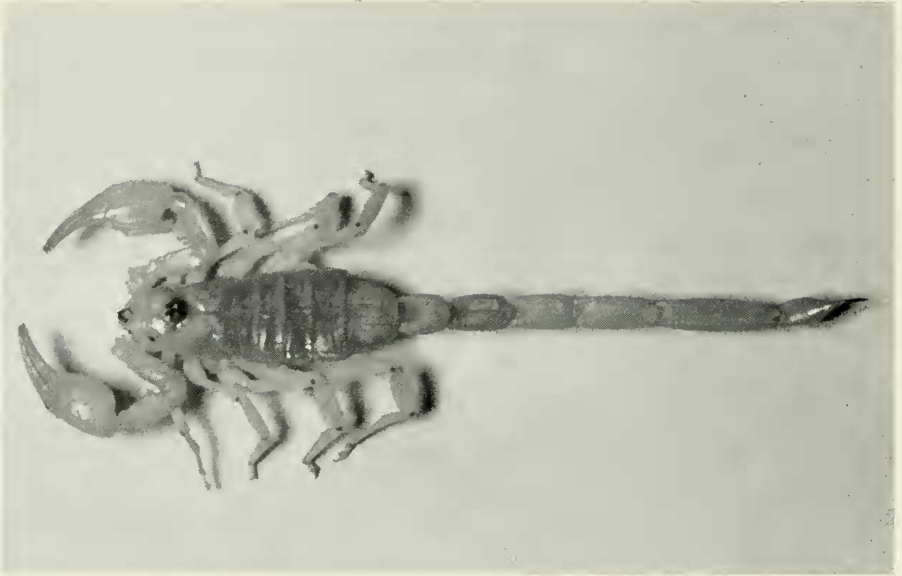


FIGURE 4. *Vejovis pallidus*, new species. Dorsal view of holotype.

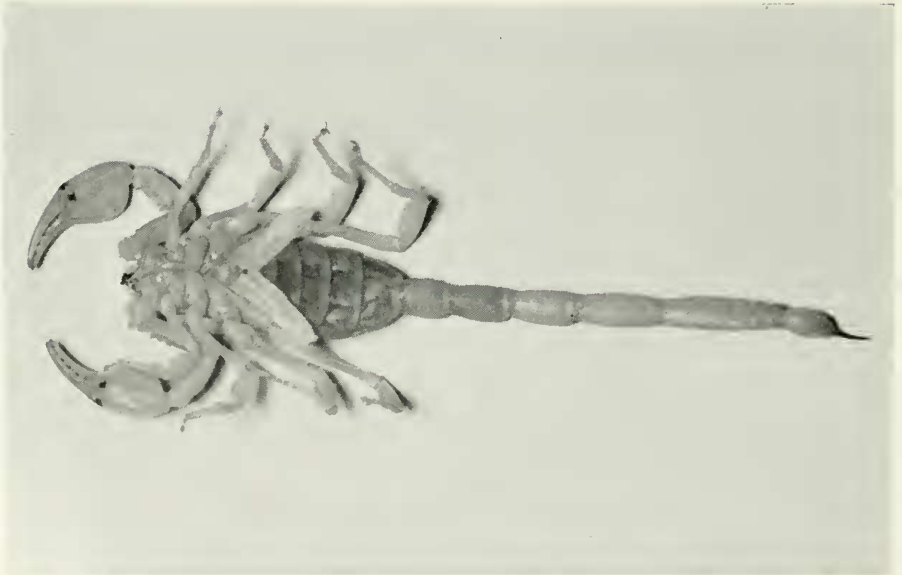


FIGURE 5. *Vejovis pallidus*, new species. Ventral view of holotype.



FIGURE 6. Sandy dune community, 0.5 kilometer southwest of Cuatro Cienegas, Coahuila, Mexico. This is the type locality for the following three new species: *Vejovis pallidus*, *Vejovis cazieri*, and *Vejovis coahuilae*. Photograph taken by Clarence J. McCoy of the Carnegie Museum.

lected in a sandy, dune community during early evening by means of ultraviolet detection. The holotype and allotype are permanently deposited in the California Academy of Sciences.

This species is named "*pallidus*" because of its pale yellow coloration.

MATERIAL. In addition to the holotype, allotype and 88 paratopotypes, eight paratypes from two other locations within the Cuatro Cienegas basin of Coahuila, Mexico were available for study: 4.3 kilometers north northwest of Cuatro Cienegas, above Rio Cañon, 27 July 1967 (W. L. Minckley), 5 males, 2 females; 4 kilometers east of Cuatro Cienegas, 27 July 1967 (S. C. Williams), 1 female.

COMMENT. This species appears to have preference for sandy habitats, reaching greatest densities in dune communities (fig. 6). This must be almost exclusively a burrowing form as rocks and other surface cover are completely lacking in areas most densely occupied. It was found in three of the 10 habitats sampled within the basin, and was the numerically dominant species in two of these. No distribution record is known outside the Cuatro Cienegas basin. Males significantly outnumbered females by a ratio of more than two to one. Most of the material consisted of adults, but juveniles were also represented in the samples. All specimens were collected by means of ultraviolet detection.

Vejovis cazieri Williams, new species.

(Figures 7, 8.)

DIAGNOSIS. Large species of *Vejovis* with base color of body brownish-yellow; pedipalp fingers contrastingly dark reddish-brown; last metasomal segment and telson contrastingly darker than other caudal segments; one pair of dark dorsal stripes on mesosoma; pedipalp palm swollen inwardly, keels distinct and granular; palm distinctly longer than fixed finger, fixed finger distinctly shorter than carapace; pectines with 16 to 19 teeth in male and 14 to 16 teeth in female. Inferior lateral and median keels of metasoma distinct and granular, not outlined with dark pigment.

DESCRIPTION OF HOLOTYPE (male). *Coloration:* Carapace with general, dark, pigmented markings, posterior margin with dark outline; posterior margin of mesosomal tergites 1 to 6 with dark outline, each tergite with diffuse pigment on each side of midline giving appearance of two dark stripes separated by a pale yellow central stripe; diffuse, dark pigment on most of metasomal segment V and telson; last two pairs of walking legs with portions of femur and patella with faint dusky markings; movable and fixed pedipalp fingers dark reddish-brown; base color of cuticle brownish-yellow, dorsum darker than venter; pectines whitish.

Carapace: Anterior margin with slight median notch and subtle emargination; set with six reddish bristles. Lateral eyes three per group, most anterior eye in each group largest. Median eyes on raised ocular tubercule; one large, erect bristle on ocular tubercule posterior to each eye; diad $\frac{1}{2}$ carapace width at that point. Carapace surface with large granules, median groove distinct and lined by large granules over ocular tubercule.

Mesosoma: Dorsal plates densely covered by large granules; median keel absent on segment 1, granular on segments 2 to 7; lateral keels absent on segments 1 and 2, one pair granular on 3 to 6, two serrate pairs on 7. Sternites agranular; one pair of crenulate keels on last sternite.

Metasoma: Lateral keels serrate over most of segment I, present as four posterior granules on II, present as two or three posterior granules on III; absent on IV; crenulate on anterior half of V. Inferior median keels of segments I to IV complete, paired and crenulate; single, serrate to crenulate on segment V. Inferior median keels set with three pairs of large reddish bristles on each of segments I to IV; inferior surface of V set with 10 pairs of reddish bristles. Intercarinal spaces on inferior surfaces of segment V smooth, lacking distinct granules.

Telson: Ventral side with about 20 pairs of long, reddish hairs, many approximating aculeus in length; subtle, subaculear tubercule present; vesicle smooth, lacking granulation.

Pectines: With 14 middle lamellae in a single row; tooth count 18/17; each

TABLE 3. *Measurements (in millimeters) of Vejovis cazieri, new species, holotype and allotype.*

	<i>holotype</i> (<i>male</i>)	<i>allotype</i> (<i>female</i>)
Total length	45.8	56.1
Carapace, length	5.6	7.4
width (at median eyes)	3.9	5.3
Mesosoma, length	12.8	15.7
Metasoma, length	21.8	25.8
segment I, (length/width)	2.8/2.8	3.4/3.4
segment II, (length/width)	3.4/2.7	4.1/3.3
segment III, (length/width)	3.8/2.6	4.3/3.3
segment IV, (length/width)	4.8/2.4	5.7/3.2
segment V, (length/width)	7.0/2.4	8.3/3.1
Telson, length	5.6	7.2
Vesicle, (length/width)	3.8/2.0	5.0/2.8
depth	1.8	2.2
Aculeus, length	1.8	2.2
Pedipalp		
Humerus, (length/width)	4.4/1.5	5.5/2.0
Brachium, (length/width)	4.8/1.8	5.7/2.4
Chela, (length/width)	8.2/2.9	10.9/3.8
depth	3.0	4.0
movable finger, length	4.3	6.2
fixed finger, length	3.4	5.0
palm, length	4.8	5.9
Pectines, teeth (left/right)	18/17	14/15
middle lamellae	14	11

sclerite of middle lamellae with two or three reddish bristles; each fulcrum with three or four reddish bristles.

Genital operculum: Completely divided longitudinally; large distinct genital papillae visible externally.

Chelicerae: Inferior border of movable finger smooth, completely lacking teeth or denticles.

Pedipalps: Hand swollen inwardly; all keels distinct and covered with large, rounded to smaller granules. Fixed finger distinctly shorter than carapace or palm; internal margin of fingers subtly scalloped, and leave no open space when fingers closed.

Standard measurements and photographs: Table 3 and figures 7 and 8.

DESCRIPTION OF ALLOTYPE (female). Morphologically the same as holotype with the following exceptions: Considerably larger in total length and mesosomal width; other body parts except pectines also proportionally larger; pectines with fewer teeth (14/15 instead of 18/17); middle lamellae reduced in number (11 instead of 14); pectines smaller in total size; no genital papillae; cuticle slightly

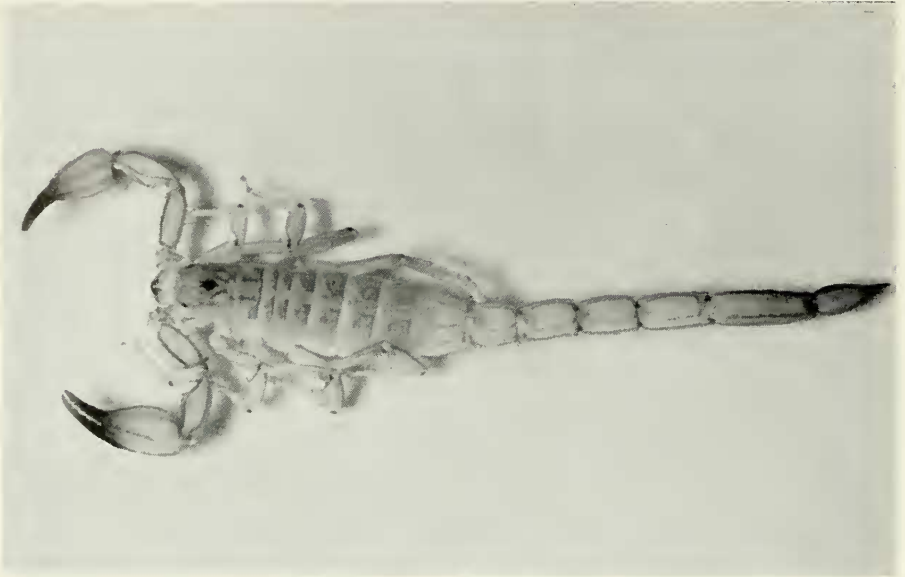


FIGURE 7. *Vejovis cazieri*, new species. Dorsal view of holotype.

more brownish, appearing somewhat darker; stripes on dorsum of mesosoma not as distinct.

Standard measurements: Table 3.

VARIATION WITHIN PARATYPES. Study of 21 paratopotypes (19 males, 2 females) indicated little variation from the structure and color of the holotype and allotype. Males varied in carapace length from 2.5 to 6.3 millimeters (mode 5.7), while the two females had carapace lengths of 3.5 and 6.5 millimeters respectively. Pectinal tooth count varied from 16 to 19 (predominantly 17 and 18) in males, and 15 to 16 in females. Almost all specimens with metasomal segment V and vesicle distinctly darker than other caudal segments. All specimens with a pair of dorsal mesosomal stripes, these more diffuse, and less distinct in a few individuals. Carapace markings varied from distinct to obsolete. Juveniles varied from adults in that their pedipalp palms were not as swollen and their dark caudal and pedipalp pigment was more contrasting. Mature females appeared to attain a distinctly larger body size than mature males. Little sexual dimorphism was apparent, sexes best distinguished by pectinal structure and by the presence of genital papillae in the adult male.

TYPE DATA AND ETYMOLOGY. The holotype, allotype, and 21 paratopotypes were collected 0.5 kilometer southwest of the town of Cuatro Ciénegas, Coahuila, Mexico, 28 July 1967, by S. C. Williams and W. S. Brown. The holotype and allotype are permanently deposited in the California Academy of Sciences.

This species is named in honor of Professor Mont A. Cazier, of Arizona State



FIGURE 8. *Vejovis cazieri*, new species. Ventral view of holotype.

University, who has significantly contributed to the understanding of the systematics, bionomics, and zoogeography of several insect groups in North America, and who has recently done much to encourage and stimulate students of arachnology.

MATERIAL. In addition to the holotype, allotype and 21 paratopotypes, five other paratypes, all from the Cuatro, Cienegas basin of Coahuila, Mexico, were available for study: Base of San Marcos Mountain, 14 kilometers southwest of Cuatro Cienegas, 28 July 1967 (S. C. Williams), 1 female; 4 kilometers east of Cuatro Cienegas, 27 July 1967 (S. C. Williams and W. S. Brown), 1 male, 1 female; town of Cuatro Cienegas, 5 April 1967 (L. E. Cullum) 1 male; above Río Cañon, 4.3 kilometers north northwest of Cuatro Cienegas, 15 August 1967 (W. L. Minckley), 1 male.

COMMENT. This species appears to show preference for sandy habitats characterized by fine, silty, sedimentary soils (fig. 6). This must be almost exclusively a burrowing form as rocks and other surface cover are completely lacking in areas most densely occupied. It was found in three of the 10 localities sampled within the basin, and was a numerically subdominant in one of these. No distribution record is known outside the Cuatro Cienegas basin. Males significantly outnumbered females by a ratio of more than four to one (22 males: 4 females). Most of the specimens were mature, but subadults were represented. All specimens were collected by means of ultraviolet detection.

Vejovis coahuilae Williams, new species.

(Figures 9, 10.)

DIAGNOSIS. Medium sized species of *Vejovis* with mature females attaining larger body size than mature males. Body base color dirty yellow; one pair of dark stripes on dorsum of mesosoma; carapace with irregular dusky markings; two pairs of dark stripes underlying inferior keels of metasoma. Pedipalp hands lacking granulation, keels reduced appearing smooth to almost obsolete; inferior keels of metasoma smooth to definitely crenulate; carapace longer than either movable finger, fixed finger or palm of pedipalp; inferior border of movable cheliceral finger completely smooth and lacking denticles; pectinal teeth varying from 13 to 16 in females and 17 to 21 in males.

This species appears related to *Vejovis spinigerus* (Wood) because of similar general coloration, color pattern and general body proportions. It differs from *V. spinigerus* in the following ways: No small, black, submedian tubercles on dorsum of abdomen; metasomal segment IV with dorsal lateral keel ending posteriorly in spine; lateral keels of metasoma not almost obsolete, but well developed and granular on segments I and II; inferior keels of metasoma not all lacking crenulation.

DESCRIPTION OF HOLOTYPE (male). *Coloration*: Base color of body brownish-yellow, this slightly darker on dorsum, pedipalps, and telson; pectines almost white; carapace with areas of distinct dusky pigmentation, this pigment most predominant anteriorly; ocular tubercle almost all black; mesosomal tergites with a pair of amorphous dark blotches separated by an unpigmented area, these forming a pair of dark dorsal stripes; dorsum of metasomal segments I, II, and V with faint diffuse dark pigmentation; all inferior median and inferior lateral keels of metasoma with underlying diffuse dark pigment, this pigment extending into the intercarinal spaces of segments IV and V; vesicle venter with diffuse dark pigment except for a pair of longitudinal yellow stripes; pedipalp with fingers reddish-amber and faint, diffuse, dusky pigment on palm underlying positions of keels; faint dusky pigmentation on humerus and brachium; walking legs with faint dusky pigment on femur and patella.

Carapace: Anterior margin with subtle median emargination, and set with eight reddish bristles. Lateral eyes three per group, anterior two about equal in size, posterior eye definitely smallest of three. Median eyes on raised ocular tubercle, one pair of reddish bristles on ocular tubercle anterior to eyes and a similar pair posterior to eyes; diad slightly more than $\frac{1}{2}$ but less than $\frac{3}{4}$ the carapace width at that point. Carapace surface irregular and densely covered with large granules.

Mesosoma: Posterior lateral region of tergites 1 to 6 densely covered with large rounded granules; medium keels present and granular on tergites 2 to 7; tergite 7 with two pairs of lateral keels on posterior $\frac{2}{3}$; these serrate to dentate.

TABLE 4. *Measurements (in millimeters) of Vejovis coahuilae, new species, holotype and allotype.*

	<i>holotype</i> (<i>male</i>)	<i>allotype</i> (<i>female</i>)
Total length	38.6	47.9
Carapace, length	4.9	6.2
width (at median eyes)	3.7	4.8
Mesosoma, length	9.8	13.0
Metasoma, length	18.5	21.8
segment I, (length/width)	2.5/3.0	3.0/3.7
segment II, (length/width)	2.8/3.0	3.4/3.5
segment III, (length/width)	3.0/2.9	3.6/3.5
segment IV, (length/width)	4.0/2.9	4.7/3.5
segment V, (length/width)	6.2/2.8	7.1/3.4
Telson, length	5.4	6.9
Vesicle, (length/width)	3.8/2.0	4.9/2.8
depth	1.7	2.3
Aculeus, length	1.6	2.0
Pedipalp		
Humerus, (length/width)	3.8/1.4	4.3/1.7
Brachium, (length/width)	4.1/1.7	5.1/2.2
Chela, (length/width)	6.7/2.4	8.4/2.7
depth	2.6	2.8
movable finger, length	3.6	4.4
fixed finger, length	2.6	3.6
palm, length	4.1	4.8
Pectines, teeth (left/right)	20/21	14/16
middle lamellae	14	11

Sternites agranular, with many reddish bristles; one pair of keels on last sternite, this smooth to crenulate.

Metasoma: All dorsal and dorsolateral keels serrate to dentate except that dorsal keels of segment V absent, these keels on segments I to IV terminate posteriorly as an enlarged spine; lateral keels complete and serrate on segment I, crenulate on posterior $\frac{1}{2}$ of II, present as about four irregular dentate to crenulate granules on posterior $\frac{1}{4}$ of III, absent on IV, irregularly serrate to crenulate on anterior $\frac{1}{2}$ of V; inferior lateral keels present on all segments, these smooth to crenulate on I and II, serrate on III to V; inferior median keels absent on segment I, smooth to crenulate on II and III, crenulate to serrate on IV, single and serrate on V. Inferior median keels set with reddish bristles, 3, 4, 5, 5 pairs on segments I to IV respectively, inferior intercarinal space of segment V with 12 pairs of large reddish bristles; inferior intercarinal space of segment V mostly smooth, but with several small groups of granules.

Telson: Ventral aspect of vesicle smooth and lustrous, lacking granulation,



FIGURE 9. *Vejovis coahuilae*, new species. Dorsal view of holotype.

with 30 to 35 long reddish bristles approximating aculeus in length; broad subaculear tubercule.

Pectines: 14 subcircular middle lamellae; 20/21 pectinal teeth. Each middle lamella with 2 to 4 reddish hairs, each fulcrum with 3 to 6 reddish hairs.

Genital operculum: Completely divided longitudinally; distinct genital papillae visible externally; 6 large reddish bristles on surface.

Chelicerae: Inferior border of movable finger completely lacking denticles; superior border with large basal tooth, two small equal sized middle teeth, and one large terminal tooth. Median and median inferior aspects of fixed finger base densely hirsute.

Pedipalps: Palms moderately swollen inwardly; keels present as reduced, agranular carinae; surface of hand smooth and lustrous. Palm, fixed finger and movable finger each shorter than carapace length. Grasping edge of fingers not deeply scalloped; teeth of proximal $\frac{1}{3}$ of fingers do not contact when fingers closed, but leave distinct open space between fingers.

Standard measurements and figures: Table 4 and figures 9 and 10.

DESCRIPTION OF ALLOTYPE (female). Coloration and patterns essentially the same as holotype except that allotype has faintly darker base color and less distinct dark markings. Structure is essentially the same as holotype except: Body size larger; keels on palm less distinct to obsolete; pectines with fewer middle lamellae (11 instead of 14), fewer teeth (14-16 instead of 20-21); with-

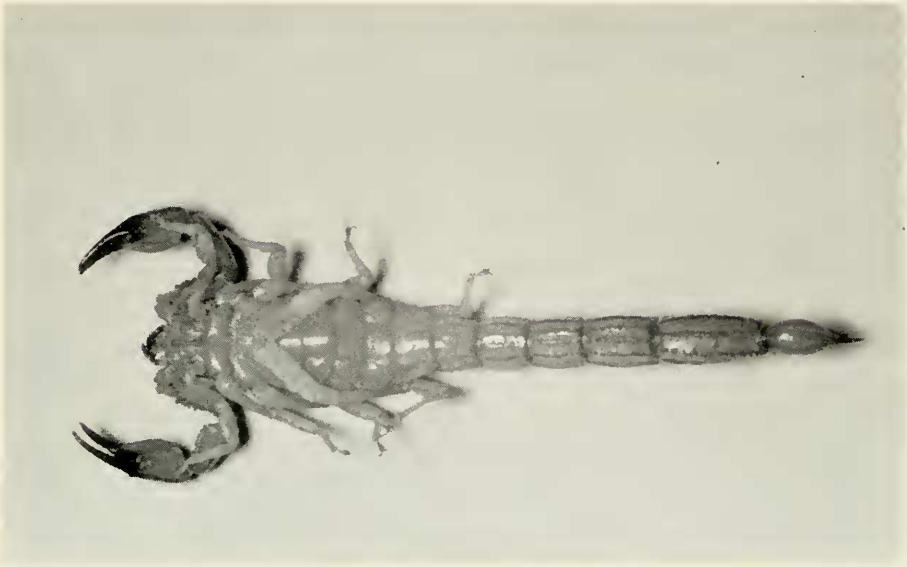


FIGURE 10. *Vejovis coahuilae*, new species. Ventral view of holotype.

out genital papillae; palm less swollen inwardly, no proximal open space when pedipalp fingers closed.

Standard measurements: Table 4.

VARIATION WITHIN PARATYPES. Study of 43 paratopotypes (19 males, 24 females) indicated little variation from the description of holotype and allotype. Males varied in carapace length from 1.5 to 5.3 millimeters (predominantly 5.0), while females varied from 1.5 to 6.3 millimeters (predominantly 5.4). Most specimens of both sexes appeared to be mature. Mature females appeared to be somewhat larger in most body proportions than were mature males. A definite tendency toward the obsolescence of both the keels and pigment on inferior surface of metasoma I was apparent. Little sexual dimorphism occurred except for, body size, structure of the pectines and presence of genital papillae. Both sexes were similar in coloration and other body proportions. Young instars were similar to adults except that: Pedipalps more heavily pigmented on all segments; metasomal segment V more heavily pigmented and much more contrasting; pedipalp hands more elongate, without inwardly swollen palm and with movable finger longer than palm. Pectine teeth 13 to 16 (predominantly 14 and 15) in females, and 17 to 21 (predominantly 19) in males.

TYPE DATA AND ETYMOLOGY. The holotype, allotype, and 43 paratopotypes were collected 0.5 kilometer southwest of Cuatro Ciénegas, Coahuila, Mexico, 28 July 1967 by S. C. Williams and W. S. Brown (fig. 6). The holotype and allotype are permanently deposited in the California Academy of Sciences.

TABLE 5. *Measurements (in millimeters) of Vejovis minckleyi, new species, holotype and paratype.*

	holotype (male)	paratype (male)
Total length	62.5	56.6
Carapace, length	7.4	6.6
width (at median eyes)	5.6	4.9
Mesosoma, length	15.8	15.3
Metasoma, length	31.9	27.9
segment I, (length/width)	4.4/3.5	3.8/3.3
segment II, (length/width)	5.0/3.6	4.5/3.1
segment III, (length/width)	5.6/3.5	4.8/3.0
segment IV, (length/width)	7.3/3.2	6.3/2.8
segment V, (length/width)	9.6/3.1	8.5/2.8
Telson, length	7.4	6.8
Vesicle, (length/width)	4.8/2.8	4.3/2.2
depth	2.4	1.9
Aculeus, length	2.6	2.5
Pedipalp		
Humerus, (length/width)	8.3/1.9	7.4/1.4
Brachium, (length/width)	8.3/2.2	7.4/1.8
Chela, (length/width)	13.0/2.8	11.7/2.5
depth	3.6	3.1
movable finger, length	9.8	7.8
fixed finger, length	8.2	7.2
palm, length	5.6	5.0
Pectines, teeth (left/right)	32/32	32/31
middle lamellae	—	23

This species is named *coahuilae* after the Mexican state, Coahuila, in which it was first collected.

MATERIAL. In addition to the holotype, allotype, and 43 paratopotypes, 48 additional paratypes were observed from nine other localities in Coahuila and Texas. These records are as follows: Mexico, Coahuila: Laguna Tio Candido, 14 kilometers south of Cuatro Ciénegas, 15 April 1965 (W. L. Minckley), 2 females; Laguna Churince, 16 kilometers south of Cuatro Ciénegas, 24 December 1965 (W. L. Minckley, C. O. Minckley) 3 females; town of Cuatro Ciénegas, 5 April 1967 (L. E. Cullum), 3 females; 4 kilometers east of Cuatro Ciénegas, 27 July 1967 (S. C. Williams, W. S. Brown), 10 males, 17 females; Pozos de la Berra, 14 kilometers southwest of Cuatro Ciénegas, 28 July 1967 (S. C. Williams, W. S. Brown), 2 males, 1 female; gypsum sand dunes, 13 kilometers southwest of Cuatro Ciénegas, 27 July 1967 (S. C. Williams, W. S. Brown), 2 males, 2 females; Travertine Ridge, 12 kilometers southwest of Cuatro Ciénegas, 15 August 1967 (W. L. Minckley), 1 female; above Rio Cañon, 4.3 kilometers north northwest of Cuatro Ciénegas, 15 August 1967 (W. L. Minckley), 1 male,

2 females. Texas (U. S. A.), Pecos County: Wil Banks Ranch, 16 kilometers north of Fort Stockton, 27 December 1966 (R. Winokur), 1 male, 1 female.

COMMENT. This species showed the widest distribution of any scorpion in the Cuatro Ciénegas basin, and was found in 9 of the 10 localities sampled. It occurred in sandy as well as rocky habitats, and was found on the gypsum dunes. Some preference was shown for sandy habitats as this species reached its greatest density in sandy, dune-type habitats where it was numerically subdominant. The specimens collected on the white gypsum dunes were distinctly lighter in base color, and had dark markings reduced as compared to specimens taken in other habitats. One distribution record is known from outside the Cuatro Ciénegas basin, Pecos County, Texas. The Texas specimens studied did not differ significantly from those collected in the Cuatro Ciénegas basin. Females were encountered in the samples significantly more frequently than were males (35 males to 54 females), and juveniles were not common among the samples. Most specimens were collected by means of ultraviolet detection, but a number were also by rock-rolling.

***Vejois minckleyi* Williams, new species.**

(Figures 11, 12.)

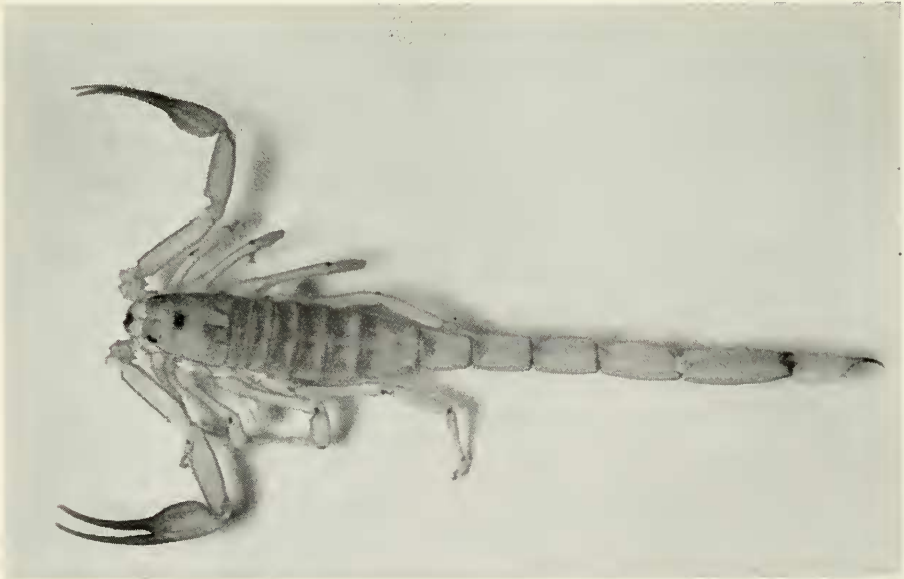


FIGURE 11. *Vejois minckleyi*, new species. Dorsal view of holotype.

DIAGNOSIS. Extremely large species, ranking among the largest species of *Vejois* described. General body color uniform light yellow; pedipalp fingers contrastingly marked with reddish-brown. Carapace, mesosoma, and metasoma



FIGURE 12. *Vejovis minckleyi*, new species. Ventral view of holotype.

without contrasting color markings. Inferior median keels of metasoma reduced and smooth except that on segment IV they are more prominent and crenulate; inferior lateral keels of segments I to IV crenulate. Movable finger of pedipalp distinctly longer than carapace or palm and approximates metasoma V in length. Male with large pectine containing 32 teeth. Movable finger of chelicera with inferior border lacking denticles.

DESCRIPTION OF HOLOTYPE (male). *Coloration:* Base color of body light yellow; walking legs slightly lighter than body; pectines white; median and lateral eyes black; fingers of pedipalps contrastingly reddish-brown, hand orange, aculeus reddish-brown. The entire body uniform in color, lacking other markings.

Carapace: Distinct notch in midanterior border; median groove running length of carapace, but with distinctly deeper pit in posterior region; three lateral eyes on each anterolateral corner, anterior two being similar size and larger than the third; two median eyes on raised tubercle located $\frac{2}{5}$ of carapace length from anterior border; each median eye with one, short, stout bristle posteriorly on ocular tubercle; width of ocular diad slightly over $\frac{1}{6}$ of carapace width at that point; entire carapace surface densely covered by granules. Median groove lined on posterior aspect of ocular tubercle by a row of large granules.

Mesosoma: Each tergite densely covered with granules; median keel on segments 3 to 7 present and granular; one pair of lateral keels on segments 3 to 6 faint and irregularly granular; two pair of distinct dentate lateral keels on



FIGURE 13. Eastern tip of San Marcos Mountain, 12 kilometers southwest of Cuatro Ciénegas, Coahuila, Mexico. This is the habitat of the paratype specimen of *Vejovis minckleyi*, new species.

tergite of segment 7. Sterna agranular; sternite of segment 7 with two pairs of keels, median pair smooth, lateral pair well developed and crenulate.

Metasoma: Inferior median keels obsolete to faint on segments I to II, faint and crenate on III, crenate on IV, single and serrate on V. Inferior lateral keels distinct and serrate on all segments. Superior keels distinct and serrate on segments I to IV, absent on V. Superior lateral keels distinct and serrate on first four segments, but irregularly granular on V. Median lateral keels almost complete and finely crenulate on segment I; serrate but present only on posterior $\frac{1}{2}$ of II; composed of four small posterior serrations on III; absent on IV; present and crenulate on anterior $\frac{3}{4}$ of V.

Telson: Basically smooth, but with irregular surface depressions; vesicle covered inferiorly by approximately 20 to 25 long reddish hairs, these hairs approximately $\frac{1}{2}$ length of aculeus.

Pedipalps: Chela distinctly elongate; palms moderately swollen inwardly; keels on hand well developed and covered with sharp serrate or large rounded granules; carapace distinctly shorter than either movable or fixed finger, but longer than palm; fixed finger longer than palm; internal border of fingers subtly scalloped but with one pronounced proximal scallop; each finger ends distally in a large overhanging, terminal tooth.

Chelicerae: Inferior border of movable finger smooth to crenate.

Pectines: With genital papillae protruding externally from genital operculum; genital operculum completely divided longitudinally.

Standard measurements and photographs: Table 5 and figures 11 and 12.

PARATYPE VARIATION. The paratype, also a mature male, did not differ significantly from the structure and coloration of the holotype other than being slightly smaller in size.

TYPE DATA AND ETYMOLOGY. The holotype was collected 5.3 kilometers northwest of Cuatro Cienegas, Coahuila, Mexico, 3 January 1965, by W. S. Parker. The paratype was collected in the second canyon from the eastern tip of San Marcos Mountain, 12 kilometers southwest of Cuatro Cienegas, 3 January 1965, by W. L. Minckley, W. S. Parker, and W. K. Taylor (fig. 13). The holotype is permanently deposited in the California Academy of Sciences.

This species is named "*minckleyi*" in honor of Professor W. L. Minckley, Arizona State University, who has enthusiastically studied the unique biology of the Cuatro Cienegas basin over the last several years, and who collected many of the first scorpion specimens known from this area.

COMMENT. The holotype was collected inside a cave, 20 meters from the entrance, on an exposed wall. The paratype was collected under a rock on powdery soil not associated with a cave. This species is known only from these two specimens.